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DEPARTMENT OF NORTHERN AFFAIRS AND
NATIONAL RESOURCES

FLORA, FAUNA, AND GEOLOGY OF THE NORTHWEST TERRITORIES



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This is one in a series of five publications descriptive of the Northwest Territories. The other publications in the series are:

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Transportation and Communications in the Northwest
Territories

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Cover Picture

At one time the musk-ox was found all over the barren grounds west of Hudson Bay, and on many of the Arctic Islands. Rapidly diminishing numbers led to stringent protection measures, and it is now forbidden to kill the musk-ox for any reason.

CANADA
DEPARTMENT OF NORTHERN AFFAIRS AND
NATIONAL RESOURCES
NORTHERN ADMINISTRATION AND LANDS BRANCH


**FLORA, FAUNA, AND GEOLOGY
OF THE
NORTHWEST TERRITORIES**

Issued under the authority of
THE HONOURABLE JEAN LESAGE
Minister of Northern Affairs and National Resources

Ottawa, 1954

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Flora, Fauna, and Geology of the Northwest Territories

INTRODUCTION

The physical characteristics of the Northwest Territories—its soil, plantlife, and climate—are such that its agricultural possibilities are extremely limited. This is the major reason why the Canadian North is, today, one of the very thinly populated areas in the world. In an area of more than one and one-quarter million square miles, over one-third of the whole area of Canada, the population is only 16,000 persons, white and native.

But the very characteristics which limit the development of the Northwest Territories in one direction give it unique possibilities of developing in other directions. For instance, the soil-forms—or, rather, the rock-forms—which limit agriculture are, at the same time, rich in mineral wealth. Again, the great distances and harsh climate, which hamper exploration and development, permit the retention of vast areas as a reservoir for a continuing population of fur-bearing mammals. Thus, while nature prohibits any substantial development along agricultural lines, she offers great wealth in mineral and fur resources.

What this means is simply that the development work undertaken by mankind is invariably patterned to existing physical facts. In the Northwest Territories, the physical facts to which development must be patterned will likely produce a type of civilization unique in human history, since a modern highly-industrialized mineral economy is approximately the opposite of the centuries-old fur trading economy.

Mineral wealth will lead men into the north and communities will spring up around the mines. But, since the surrounding land will be unproductive agriculturally, the wilderness will be at their back door. All the most modern methods of transportation, communication, and living will be brought to bear on the development of the Northwest Territories, but still the cold, the barrenness, and the distance will continue to exist. Even as the homes, theatres, and restaurants are built in the future towns of the Canadian North, the fur trapper, not far off, will continue to set his traps as he has done for centuries. As a new type of civilization, it will likely be a peaceful co-existence of the old and the new.

In the following pages, descriptions are given of the plantlife, the animals, the land forms, and the climate of the Northwest Territories. These are the physical characteristics which civilization will shape to its ends and which, in turn, will determine the particular type of civilization that will evolve from the development of the Northwest Territories.

Forests

The eastern part of the Northwest Territories is almost devoid of forests, but in the Mackenzie District there are areas of forested land, varying in nature from scattered clumps of stunted conifers and birches near the northern limit of tree growth close to the Arctic Circle to fairly heavy stands of poplar and spruce near the larger rivers in the southerly part of the District. The principal tree species are aspen and balsam poplar, white and black spruce, white birch, tamarack, and jack pine.

In the broad forest classification of Canada, all the forested lands within the Northwest Territories fall into four subdivisions or sections of the boreal forest region. Two of these, the mixedwood and northern coniferous sections, are represented by relatively small areas adjacent to the boundaries of Alberta and western Saskatchewan. The remainder of the forested land is included in the Mackenzie lowlands and northern transition sections.

The mixedwood section occupies a small area along the Alberta boundary south of the west end of Great Slave Lake and the Mackenzie River. It is believed to afford the best growing conditions for forests in the Northwest Territories. Soils are of glacial origin, of considerable depth, and usually well drained. Aspen and white spruce are the typical trees, accompanied by all the other species found in the boreal forest region.

The northern coniferous section occupies a small triangle immediately east of Fort Smith with its base on the northern Alberta boundary. Soils are shallow and drainage is poor. Black spruce is the principal tree species and it is sometimes found in mixture with jack pine and tamarack in the lower, wetter areas.

The Mackenzie lowlands section is the most important forest area of the Northwest Territories. As the name implies, it occupies the low-lying plains in the basin of the Mackenzie River and embraces the lower portions of the Liard, Peel, and Great Bear Rivers. The soil is of glacial, alluvial, and lacustrine origin, and is generally of good depth. Although the sub-soil is never free from frost, trees grow to a fairly good size. White spruce, the poplars, and birch are well represented; black spruce and tamarack occupy the swamps and jack pine is found in the sandy areas.

The northern transition section lies north and east of a line passing through the mouth of the Mackenzie River to Great Bear and Great Slave Lakes. Unfavourable climatic conditions, thin soils, and poor drainage result in stunted growth.

In general, forests occur chiefly on two sites; the alluvial flats stocked with white spruce, and the well drained slopes of rivers supporting a smaller growth, chiefly poplar, spruce, and jack pine. The timber on the flats is of sawlog size, but its extent is limited. An important question, as yet unanswered, is whether the slope sites will grow large timber.

Considerable progress has been made by the Federal Forestry Branch in studies of the forest-cover of the Northwest Territories. These studies have been made through the medium of air survey, photographic interpretation, and field inventory surveys.

Arctic Plantlife

Plantlife in the Arctic resembles in a good many respects that found in alpine regions of high mountains in more southern latitudes. Several life-forms and a great many species are common to both the arctic zone and to mountain areas more than a thousand miles south. The principal physiographic difference is in the length of the day and the length of the growing season. But in high mountains, the accumulation of snow is often so great that the length of the effective growing season may closely approach that of the Arctic. Thus, above timber-line at Banff in the Canadian Rockies, in latitude 52 degrees North, the collecting season for botanists is approximately from July 1 to August 15. This period closely corresponds to that



Many types of plantlife flourish in the Canadian North. Indigent to damp, marshy areas is *Eriophorum*, which, because of its appearance, is often called "arctic cotton".

of the somewhat lower mountains west of the Mackenzie Delta, 16 degrees of latitude north of Banff, and, indeed, to the collecting season for most of the Canadian Arctic.

It is an adaptation to the short arctic summer that almost all truly arctic plants are perennial and develop the next year's flowering buds before the onset of winter. Summer is too short for annual species to complete a life cycle in one season. The failure of a single seed crop might exterminate the species in a local population. Most arctic plants require many years from germination to the first flowering. Many do not depend entirely on seed production for their propagation but are protected against unfavourable seasons by various means of vegetative reproduction.

In the Arctic there are no climbing plants, plants that sting or poison, nor any that are protected by spines or thorns. The implication, of course, is that such protection is not needed. Many are xerophytes; that is, plants adapted to withstand prolonged drought by having rather small, leathery leaves, often covered by densely matted hairs that provide a felt-like covering for the stomata.

The arctic zone in North America comprises the Arctic Archipelago and, on the continent, all the treeless country lying north of the transcontinental coniferous forest. The southern boundary of the arctic zone thus coincides with the northern tree-line.

Plants in the Arctic do not grow haphazardly amongst each other. Those having similar requirements as to soil, moisture, and wind or snow protection generally grow together in more or less well-defined communities. Four such major plant communities may be recognized in the North American Arctic, each capable of subdivision into a number of more or less distinct associations, the relative importance of which again depends on the physiography of the landscape.

- (1) Rock desert or fell-field communities:
 - (a) Rock desert.
 - (b) Unstable screes and stone creeps.
 - (c) Gravelly river flats and fans.
- (2) Tundra communities:
 - (a) Dwarf-shrub heath.
 - (b) Lichen and moss heath.
 - (c) Grassland.
 - (d) Willow and alder thickets.
 - (e) Marsh and wet tundra.
 - (f) Snowflashes.
- (3) Strand communities:
 - (a) Lagoon and salt marsh subject to floods.
 - (b) Sand dunes and gravel beaches.
 - (c) Rocky shores.
- (4) Vegetation of fresh waters:
 - (a) Ponds and lakes.
 - (b) Brooks and rivers.

The most striking of these, perhaps, is the arctic rock desert which occupies vast areas of rock-strewn, barren flats that from the air look entirely devoid of vegetation but which, each summer for a short time, may be transformed into veritable arctic "rock gardens". The arctic tundra, which is best developed on the mainland, differs from the rock desert by having a closed or continuous plant cover; some tundra is rich in grass-like plants and lichens and provides excellent grazing for large herds of caribou and musk-oxen.

Few native arctic plants are of direct importance in the economy of man. None of the woody species are large enough for constructional use by the Eskimo, who, at least formerly, obtained what little wood he needed chiefly from driftwood. Heather and berry bushes, stunted willows, alder, and ground birch are used by the Eskimo for cooking purposes; nearly all the larger lichens are highly inflammable when dry and may be used for cooking. Raw peat, particularly heath turf, but also partly decomposed sphagnum moss, is available nearly everywhere in the Arctic and is an important source of fuel.

Indirectly, the arctic vegetation is of great importance to man because it furnishes food for grazing animals. Seeds, winter buds and roots, and stems or leaves of many species are eaten by birds and small rodents that, in turn, constitute the food of some of the fur-bearing mammals. Likewise the comparatively rich marine plantlife indirectly furnishes food for the sea mammals so important in the economy of the Eskimo.

The leaves, stems, roots, or berries of a small number of arctic plants are used for food by native and white inhabitants. Of greatest potential food value are the lichens, though none are used by natives. Several species of edible fleshy fungi (mushrooms) are found in the Arctic, but, like the lichens, are not eaten by natives. Among the Eskimos, the dependence on vegetable food varies from group to group, according to tradition and according to what plants are available; thus to the most northerly tribes, the use of vegetable food is purely incidental and largely limited to the partly fermented and pre-digested content of the rumen of caribou, whereas, in the diet of the Eskimos of Alaska, Labrador, and Greenland, vegetable food constitutes a regular, if not very large, item which, however, is important from a dietary point of view as a source of ascorbic acid and thiamin.

FAUNA

Throughout the Northwest Territories wildlife is of the greatest importance to the native economy. From the native animals the Indians and Eskimos get furs, which they trade for the white man's goods, and flesh, which is frequently their sole sustenance. They use the skins of the larger mammals for clothing and bedding. They make harpoon lines and ropes from the hides and intestines of various animals. They use ivory, teeth, bones, and sinews of many of the mammals for many different purposes.

Even before the white man introduced firearms into the North, there were times of scarcity when many Eskimos starved to death. At present, with the Eskimo hunting efficiency greatly increased, it is most important that wildlife resources be utilized carefully. With this in mind, various Government Ordinances and Acts have been passed to preserve wildlife and to make sure that wildlife is used only by those who need to use it.

Possibly the most important set of regulations is called the Northwest Territories Game Ordinance. This Ordinance controls the taking of mammals in the Northwest Territories, and, under it, vast areas have been

set up as game preserves. The Arctic Islands Game Preserve, for example, contains 772,302 square miles of land. Over all the Arctic Islands only natives or half-breeds can hunt, with the exception that scientific permits may be granted under special conditions for the taking of animals by other persons, and, in real emergencies, game can be taken by anyone.

The Migratory Birds Convention Act applies in the Northwest Territories as well as in the provinces. Migratory birds, their eggs, and their young are strictly protected except during stated open seasons for certain species.

Marine mammals are protected under the Fisheries Act. Larger whales are protected under international agreement and beluga, walrus, and seal are protected under special regulations.

Tundra (Barren-Ground) Mammals

The musk-ox, *Ovibos moschatus*, formerly ranged throughout the barrens, but now it is greatly reduced in numbers and distribution. The largest concentrations of musk-oxen are found on some of the islands of the Arctic Archipelago. The colour of this long-haired animal varies from dark brown to black, except the "saddle" between the shoulders and the ankles which is whitish.

As a means of defence against an enemy, a group of musk-oxen will form a circle with their heads turned outward. In this formation, the animals can ward off the attacker by means of their massive horns.

Musk-oxen have been fully protected from hunting since their numbers have become dangerously reduced. Early white explorers have been blamed for this situation because some of them indulged in indiscriminate and wasteful hunting practices.

The polar bear, *Thalarctos maritimus*, is distributed along the coasts of the Arctic mainland northward to some of the Arctic islands and southward, occasionally to the Gulf of St. Lawrence. In common with many arctic mammals these bears are uniformly white in colour. They are marine mammals which remain mostly on the floe-ice except in summer when they may be seen on the land. Seals form the bulk of their diet while young walrus and other marine mammals are eaten occasionally. These bears are frequently followed by arctic foxes which feed upon the remains of animals left by them.

Arctic foxes, *Alopex lagopus*, are one of the characteristic mammals of the tundra regions of both the eastern and western Arctic. Economically, the fox is one of the most valuable mammals in the region since from the sale of its fur a number of inhabitants procure their essential food and hunting supplies.

There are two colour phases of the fox, the white and the blue. In summer, the white phase changes from white to a smoky-brown colour. The colour of the blue phase is a smoky-greyish-brown or various degrees of brown-grey, the colour remaining throughout the year. In winter, the fur becomes thicker, the hair lengthens, and the general colour of the coat

is a smoky-blue. These colour phases are genetically determined and the animals interbreed freely. The blue phase, which is more valuable, is exceedingly scarce throughout the Canadian Arctic regions.

The abundance of arctic foxes fluctuates periodically, with the peaks occurring about every three to five years. The length of this cycle is shorter than the cycle of the other fur-bearers which occur south of the tree line. For example, the length of the cycle in red foxes is about 10 years. The periodicity of arctic foxes has been correlated with the periodic fluctuations in the populations of lemmings. This correlation is closer in areas where lemmings form the major percentage of the diet of arctic foxes.



Two species of lemming prevalent in the Canadian North are the brown lemming and the Greenland varying lemming. These creatures, which resemble a large, chunky field mouse, can increase from scarcity to incredible numbers in two or three seasons.

Lemmings are rodents somewhat resembling large, chunky field mice. Two species, the brown or Back's lemming, *Lemmus trimucronatus*, and the collared or varying lemming, *Dicrostonyx groenlandicus*, are quite common in the Canadian Arctic. The collared or varying lemming is pure white in winter and has remarkably long, silky fur. Both kinds are brown in summer and the Back's lemming does not turn white in winter. Relatives of these little creatures are famed in Europe for their occasional migrations, which sometimes take them into the sea in incredible numbers. In Canada,

migrations which end in death in the sea have not been described. The animals do, however, increase to a high point in numbers every three or four years and then die off rather rapidly. This fluctuation in numbers is one of the most remarkable and, at the same time, least understood phenomena in the animal world. Carnivorous mammals and birds which live largely on the lemmings fluctuate in numbers with their prey.

Barren grounds hare, *lepus arcticus andersoni*, is an important source of food for both humans and other animals. Normally these hares hop on all fours, but, when startled, can travel faster by standing on their hind feet and running. They retain their white colour throughout the year.

Woodland Mammals

The wooded sections of the Northwest Territories contain a far greater variety of mammals than do the barren grounds. Included are big-game animals and most of the valuable, fur-bearing animal types for which Canada is famous. Some of the more important species are listed below.

Moose—The moose, *Alces americana*, is fairly plentiful in certain sections and ranges north to the limit of trees. Occasionally, but not often, it is found some distance out on the barren areas. This animal is of considerable importance to the Indians for food and clothing.

Mule deer—The mule, or jumping deer, *Odocoileus hemionus*, is found occasionally in the southern portion of the Mackenzie District. It does not, however, occur there frequently enough to assume any economic importance.

Wood Buffalo—The wood buffalo, *Bison bison*, is restricted to Wood Buffalo Park and adjacent areas partly in Alberta and partly in Mackenzie District. During 1923-27, more than 6,000 plains-buffalo were shipped to this area from Buffalo National Park. The two forms have apparently interbred and there are now about 12,000 buffalo in the area. In the northern sections of the range, wood buffalo can still be recognized as being larger and much darker animals. A big buffalo may measure 12 feet in length and weigh 2,000 pounds, the largest native land animal in North America.

Dall's Sheep—The nearly pure white Dall's sheep, *Ovis dalli*, is found occasionally in Mackenzie District in the mountains west of the Mackenzie River. A few are shot annually by natives from Aklavik, north of the Arctic Circle.

Mountain Goat—The mountain goat, *Oreamnos americanus*, occurs occasionally in the mountainous Nahanni region in the southwestern part of Mackenzie District.

Black Bear—The black bear, *Euarctos americanus*, is a fairly common animal in the wooded region of the Northwest Territories. It is of some value to the Indians for food and hides and sometimes makes a nuisance of itself by destroying food caches and breaking into cabins.

Coyotes—The coyote, *Canis latrans*, is found occasionally in Mackenzie District as far north as the Mackenzie Delta.

Fur-Bearing Animals

Six important fur-bearing mammals live only in the wooded sections of the Northwest Territories. These are the beaver, *Castor canadensis*; muskrat, *Ondatra zibethica*; mink, *Mustela vison*; marten, *Martes americana*; fisher, *Martes pennanti*; and lynx, *Lynx canadensis*. All of these species are important to the fur industry throughout Canada. In the Northwest Territories they are particularly important, since most of the natives live solely by hunting and trapping. The muskrat, marten, and beaver are the most important from the financial viewpoint. While muskrats supply the least expensive of these furs, they are trapped in the greatest numbers and supply a large yearly revenue.

Many other mammals of lesser importance (but of some interest) are found in the wooded sections of the Northwest Territories. The varying hare, or snowshoe rabbit, *Lepus americanus*, is quite abundant at times and may form an important food supply for Indians and some wild animals. It fluctuates in numbers and reaches a peak about every ten years. Squirrels, skunks, chipmunks, mice, and shrews are also found in wooded areas in the Northwest Territories.

Other Terrestrial Mammals

There are a number of mammals, including some of those of greatest importance as game and fur, which are found both on the barren grounds and in the wooded sections of the Northwest Territories. Some of these are found in the woods only in winter and on the barren grounds only in summer. Others may be found in both areas at any time of the year. The following are the more important of these animals.

Caribou—The most important land mammal in the Northwest Territories from the point of view of the Indians and Eskimos is the barren-ground caribou, *Rangifer arcticus*. It provides them with food and its skin excels that of all other mammals for winter clothing and sleeping robes. Its meat is excellent for eating, either fresh or dried; its antlers and bones provide material for tools and implements; its sinews are used for sewing and other purposes; and its fat is used for fuel and food. Natives even eat and relish the brains and marrows of caribou and the contents of their stomachs. The largest herds are found on the mainland and groups numbering many thousands are frequently encountered in migrations from one seasonal range to another. In summer the majority of the barren-ground caribou are on the barrens, but in winter they are found in number in the wooded sections as far south as the northern regions of the three Prairie Provinces.

There are several kinds of caribou in the Northwest Territories. A larger, darker animal, the Stone caribou, is found in the Mackenzie Mountains. In the high Arctic, on the northern islands, a small, light-coloured animal, Peary's caribou, is found. A fourth kind of caribou, markedly different from those mentioned above, is found in small numbers in the wooded districts from northern Manitoba to the Anderson River, overlapping widely the winter range of the barren-ground caribou. This is the woodland caribou, *Rangifer caribou*.

Grizzly Bear—Grizzly bears, belonging to the family *Ursidae*, are found in the Northwest Territories largely on the barren grounds but occasionally in the most northerly wooded sections. They are at present very rare animals. In fact, they are probably the rarest big-game animal in the Northwest Territories. Several kinds of grizzly are recognized, but specimens have been taken for museums so infrequently that there is much controversy over their exact classification. These large bears are not, as a rule, dangerous, for they avoid man wherever possible.



Great herds of caribou, on which the natives depend for food and other necessities still range the tundra areas of the Northwest Territories. Seen from the air, these migrating caribou dot the plain below.

Wolf—The wolf, *Canis lupus*, is common throughout Northern Canada. It ranges from the most southerly wooded districts in the Northwest Territories to the high Arctic Islands. Several kinds of timber and tundra wolves are described, but they are all essentially the same. The most northerly animals are generally all white or white with a faint black saddle on the back. The more southern animals are usually grey or black, but all sorts of colour variations may be found. The wolves in the Arctic are, generally speaking, not as large as those in the more southerly sections, and the wolves in Wood Buffalo Park are probably among the largest in the world. Except

in the denning season, wolves commonly roam over extensive areas taking such prey as is most readily available. Despite many stories and legends to the contrary, wolves are not dangerous to man unless provoked but they destroy some game and some trapped animals.

Red Fox—The red fox, *Vulpes fulva*, is an extremely common animal in the wooded sections of the Northwest Territories and, in recent years, is becoming more common on the barren grounds. The reason for this northern movement is not clearly understood, but it is a fact that red foxes are now found as far north as the Arctic Coast in places where they were not found a few years ago. In the wooded district, the red fox frequently lives on the varying hare and increases and diminishes in number in a manner similar to the hares. On the barren grounds, however, the foxes live on lemmings and have a short-term fluctuation in numbers corresponding to that of the lemmings. Red foxes show a great variety of colour. Red or orange-red is, of course, the commonest, but, black, silver, and yellow are also common colour varieties. Another common variation of this species is the cross fox, essentially a red fox with a dark cross or saddle on its back.

Weasel—Two kinds of weasels are found in the Northwest Territories. These are the short-tailed weasel or ermine, *Mustela erminea*, and the least weasel, *Mustela rixosa*. Both of these weasels turn white in winter and both are found on the barren grounds, although the short-tailed weasel is also found on the Arctic Islands. The least weasel is much the smaller of the two species. In both species, females are much smaller than males.

Wolverine—The wolverine, *Gulo luscus*, is found throughout the mainland sections of the Northwest Territories, on Baffin Island, and, occasionally, on some of the other Arctic Islands. The wolverine is a relatively small animal, hardly larger than a fox, but its habits and exploits are such that it has assumed an almost legendary reputation. Wolverines are extremely powerful for their size and are great wanderers. They apparently take pleasure in raiding all but the strongest food caches and in tearing up and destroying trapped animals on trap-lines. Frequently, their depredations appear to have nothing to do with the desire for food but are carried on merely for the pleasure of destroying something. They are the most unpopular animal in the North.

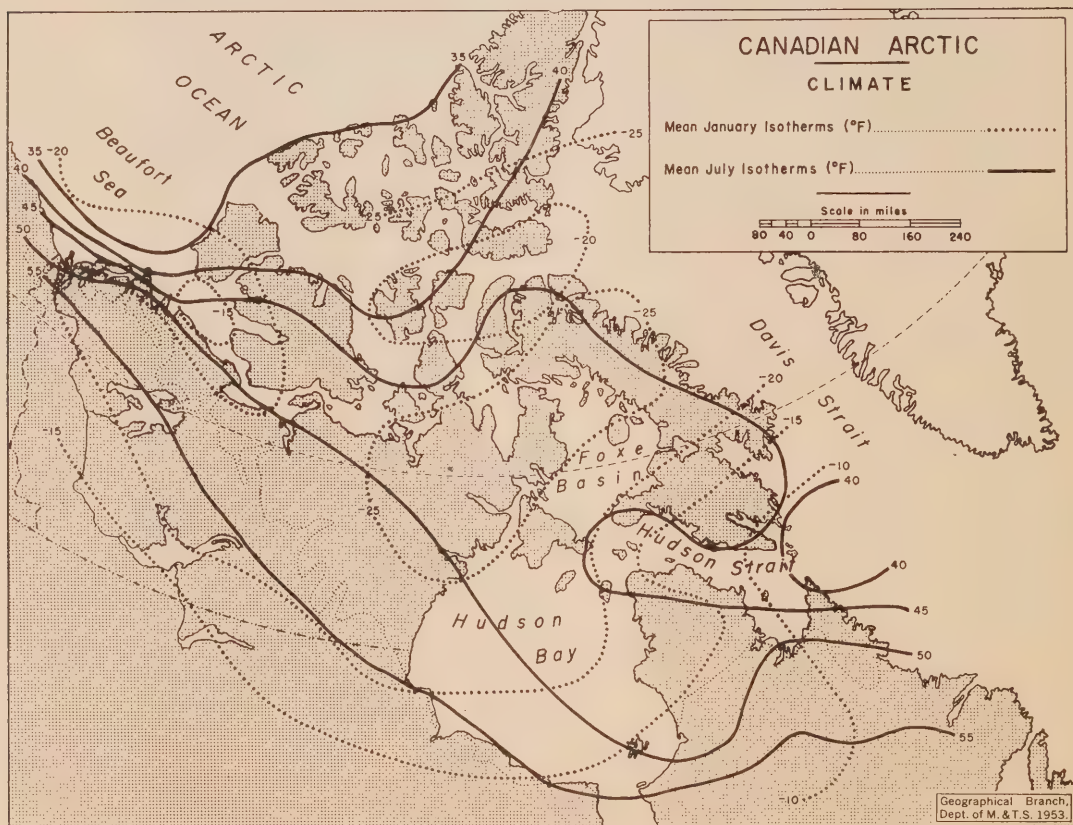
A few other small mammals, notably ground squirrels and some species of mice, are common to both the wooded and barren sections of the Northwest Territories.

Marine Mammals

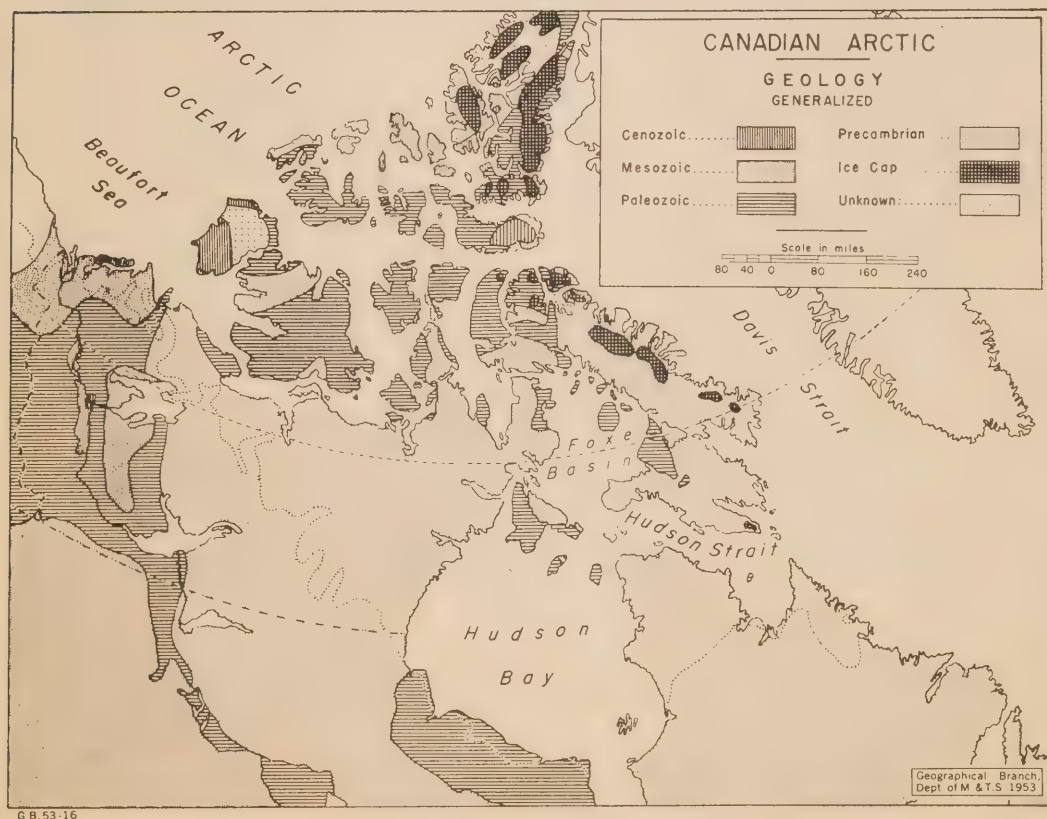
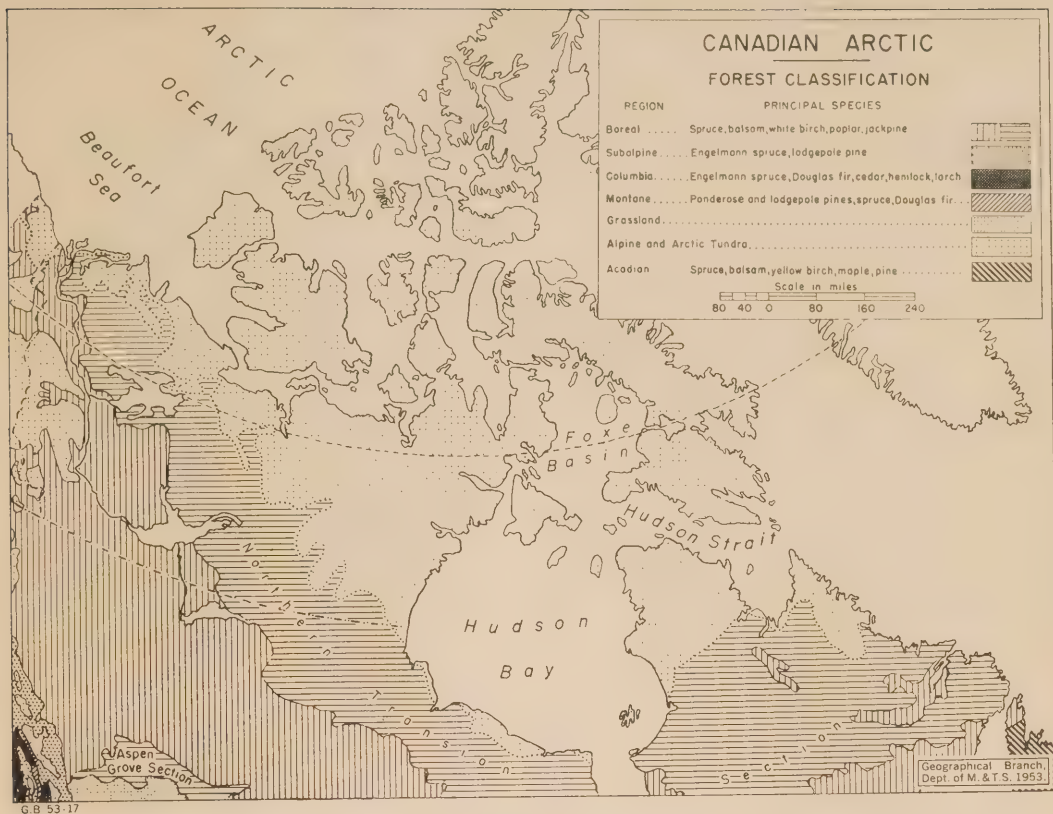
All marine mammals play an important part in the economy of the inhabitants of the Arctic regions. They are essential parts of the food supply of the Eskimos, and from some of them are obtained material for clothing and other articles. Some are also of commercial value to the white traders. The seals, of which there are several varieties, are perhaps of the greatest



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economic importance to the Eskimos. From them are obtained food, clothing, dog food, and material for implements. The following descriptive notes deal only with the more important species of marine mammals.

Arctic Ringed Seal (rough or jar seal)—*Phoca hispida*, is the commonest seal along the coast of both the Western and Eastern Arctic regions. It is the chief source of food of some of the Eskimos. The hide is used for making waterproof boots, and the dehaired skin for other garments, especially when caribou are scarce. The skins are also purchased by the traders, but do not bring a high price. The young are born in an opening in the snow beside the breathing hole in the ice, and, when born, are covered with a white, woolly fur. The ringed seal is found as a freshwater resident or semi-resident in Lake Nettilling, Baffin Island.

Bearded Seal (ground seal or square-flipper)—*Erignathus barbatus*, is a circumpolar species which is common west of Darnley Bay. It is abundant in the vicinity of Dolphin and Union Strait, south of Victoria Island. Owing to its large size (up to 800 pounds) it is much prized by the Eskimos, as it provides a great amount of meat and blubber. Its heavy hide is used for boot soles and for covering the large skin boats, and is cut into heavy line which is used for dog traces, harpoon lines, and lashings of any kind. The bearded seal's diet consists of crustaceans and mollusks.

Harbour Seal, *Phoca vitulina*, is not as common as the ringed seal. In certain parts of the Eastern Arctic it is of considerable importance to the Eskimos. It occurs sporadically throughout the Eastern Arctic, and is taken in some numbers near the Button Islands in Hudson Strait. It is the common seal of the temperate Atlantic and Pacific coasts of Canada, but in its Arctic range it tends to be darker in coloration. It frequently ascends fresh water.

Harp Seal (saddleback or Greenland seal)—*Phoca groenlandica*, is a migrant seal which spends the summer in the North. An Atlantic form, (the group breeding in the vicinity of Newfoundland), is common in Greenland waters and in the Eastern Canadian Arctic in summer. Formerly it was more abundant in Hudson Bay than it is at present, but it is still common in Hudson Strait and the eastern coast of Baffin Island, and is known as far north as Ellesmere Island. It is sometimes seen in large schools. One migration route passes Port Burwell, where the harp seals are still taken in the autumn by the few remaining Eskimos at that settlement.

Atlantic Walrus, *Odobenus rosmarus*, has become scarce and is rarely found in the Atlantic Ocean south of Hudson Strait, although at one time it ranged much farther south. In Hudson Bay, it is found as far south as the Belcher Islands. Apparently the western limit of range of the Atlantic walrus in the south is Fury and Hecla Strait, and, in the north, the upper part of Prince Regent Inlet and the middle of Barrow Strait, south of Cornwallis Island.

Pacific Walrus, Odobenus divergens, seldom goes east of Point Barrow, Alaska, although it was formerly plentiful as far as Cape Bathurst. The killing of walrus, except for food, is prohibited, and only Eskimos may kill them without a licence. The export of walrus tusks or ivory, except in the form of manufactured articles, is legal only by permit from the Minister of Fisheries.

Atlantic Killer Whale, Grampus orca, is cosmopolitan in its range. It is found in all oceans and seas, tropical and polar alike, from Novaya Zemlya, Baffin Bay, and Bering Strait to beyond the Antarctic Circle in the Southern Hemisphere. The species is not known to occur in Hudson Bay, but has often been reported in Eclipse Sound, north of Baffin Island, and in Davis Strait and Baffin Bay.

Bowhead or Greenland Whale, Balaena mysticetus, was at one time very plentiful in Baffin Bay and Hudson Bay and Strait. Great numbers of whales were killed during the whaling season, and they soon became so scarce that it was unprofitable to hunt them especially after the drop in the price of whale-bone and the introduction of mineral oils, which replaced whale oil as a lubricant. Before the introduction of firearms, the natives of some localities captured the bowhead by lancing it from their skin boats; they used the flesh for food, and the oil for food and fuel. The bones were used for making implements.

Common Finback, Balaenoptera physalus, occurs in all large oceans; it is limited in its northward range by the pack ice of the Arctic Ocean and in the south by the antarctic ice. In summer, it reaches the open seas about Spitzbergen, following the northeastern extension of open water. On the western side of the Atlantic Ocean, it is uncommon north of Davis Strait, but may follow open water in Baffin Bay as far north as Melville Bay on the west coast of Greenland. Early records state that finbacks were at one time taken in great numbers.

Humpback Whales, Megapterinae, are generally distributed in the oceans of the world. It is suspected that they pass the winter in tropical and sub-tropical waters, migrate regularly along well-defined courses, and return to arctic and antarctic waters in spring.

White Whale, Delphinapterus leucas, is found in arctic and sub-arctic seas as far north as latitude 74 degrees, and is occasionally found as far south as Cape Cod, Massachusetts. These whales are much prized by the Eskimos, especially when they enter bays and estuaries in large schools under which conditions they may be taken easily.

Narwhal, Monodon monoceros, is found usually in the more northern waters, preferring the proximity of the ice, so that, in summer, its range is more northerly than that of the white whale. These whales are especially abundant at Pond Inlet and in the icy waters of Foxe Channel and Frozen Strait. They were at one time abundant in Cumberland Sound and along

Hudson Strait: The long, spiral, twisted horn possessed by these creatures is an overgrown incisor tooth projecting directly forward from one side of the upper maxillary. It may measure over eight feet in length and weigh over fourteen pounds. In rare instances, specimens have been taken with two such horns.

Fish

Arctic Char, *Salvelinus malma*, not to be confused with Atlantic Salmon, is perhaps the most important food fish of the Arctic. This species occurs in great numbers in certain seasons of the year and is found in both fresh and salt water, chiefly near the mouths of rivers in the latter case. These fishes are plentiful in parts of the Eastern Arctic, principally the Baffin Island area, the rivers of Melville Peninsula, and the northern parts of Hudson Bay. They also frequent the coastal waters of the northwestern mainland of the Northwest Territories. Despite the abundance of Arctic char, thought has been given to the question of its vulnerability. It is plentiful, but not commercially exploitable, chiefly owing to the pattern of its distribution and to the fact that growth rates are low. Even with Eskimos fishing alone, local populations of char are sometimes reduced to dangerously low levels. A systematic study of the Arctic char is now being made.

Atlantic Salmon, *Salmo salar*, is found westward as far as the Koksoak River. It is important to the economy of the Eskimos in that region.

Arctic Halibut, *Reinhardtius hippoglossoides*, has been found only recently in the waters of the Northwest Territories, at Burwell, in 1947, and so far only young fish have been observed.

Whitefish, *Coregonus clupeaformis*, is found in almost every lake or stream of the mainland. Many of the early explorers depended on it to a large extent for food and it still plays an important part in the food economy of sparsely settled regions. It makes an excellent dog food for winter travel.

Round Whitefish (Frost fish), *Prosopium cylindraceum*, is a species of whitefish of which little is known as to abundance or distribution in the Northwest Territories.

Arctic Cod, *Boreogadus saida*, is widely distributed in Hudson Bay and among some of the islands of the District of Franklin.

Atlantic Cod, *Gadus callarias*, has been taken at Port Burwell at the entrance to Hudson Strait, and at Resolution Island. Cod weighing up to 40 pounds are taken in a tidal lake in Frobisher Bay.

Pacific Tom Cod, *Microgadus proximus*, is found in Western Arctic waters as far east as Coronation Gulf and is abundant in some localities. These cod are taken through the ice with hooks and are also caught by the Copper Eskimos with a large barbless hook holding small bone bangles. Other members of the cod family are occasionally caught in the Eastern Arctic.

Atlantic Tom Cod, *Microgadus tomcod*, is reported from the Labrador coast.

Greenland Cod, *Gadus ogac*, is common but not abundant in the waters of the Eastern Arctic.

Flounder, a Pacific species, the starry flounder, *Platichthys stellatus*, is found east to Coronation Gulf.

Inconnu (Conny), *Stenodus leucichthys*, inhabits most of the large rivers of the Northwest Territories west of Anderson River, ascending them as far as the first rapids. These fishes are of low vitality and are sluggish, which probably explains why they are not found above any heavy rapids in the streams they frequent. They average from 8 to 20 pounds. In the Mackenzie River system, the inconnu probably winter at the Mackenzie Delta and in Great Slave Lake. They ascend the rivers about June and return in October. They spawn at Fort Smith from about mid-September to October and are found in great numbers in the eddies below the rapids. At the mouth of the Mackenzie River, they are caught by the Eskimos through the ice by means of hook and line baited with an ivory lure. The larger connies are not palatable but the smaller ones, when dried and smoked, are suitable for human consumption. Connies make excellent dog food.

Grayling, *Thymallus signifer*, or bluefish as it is called in the Mackenzie region, is widely distributed but is found only in clear lakes and rivers. Grayling is excellent as food and game fish.

Suckers, *Catostomus catostomus* and *Moxostoma aureolum*, are found in most of the waters of the Mackenzie Delta and in the rivers of the Mackenzie Valley. They are used for dog food when other fish are not obtainable.

Cisco, (Tullibee, Lake Herring) *Leucichthys* sp., is found in the brackish portions of Hudson and James Bays and also along the Arctic Coast and in the Arctic Red River, where it is abundant in the spawning season in September. Several species occur in the mainland portions of the Northwest Territories.

Great Bear Lake Herring, *Leucichthys lucidus*, is a common food fish in the Western Arctic along the coast as far as Coronation Gulf. It is caught in nets during the summer and by hooks during the ice season.

California Herring, *Clupea pallasii*, is abundant in the waters about Cape Bathurst in late August, where it is taken in nets in large numbers.

Lake Trout, *Cristivomer namaycush*, is a very excellent food fish and is found in most of the large inland lakes in Mackenzie and Franklin Districts, especially in deep waters. These trout occasionally reach a weight of 60 pounds.

Pike (Jackfish), *Esox lucius*, is found along the north mainland coast, from Alaska to Cape Bathurst, in the rivers and inland lakes, and is especially abundant in the region of the Mackenzie Delta. Pike weigh as much as 35 pounds, but average from 5 to 15 pounds. They frequent clear pools at the foot of falls and rapids and the deeper lakes.

Smelt, *Osmerus dentex*, is common about the Arctic Red River and is an important food in that locality.

Burbot, (Ling, Loche), *Lota lota*, is found in most of the fresh and brackish waters of Mackenzie and Keewatin Districts, but is not abundant. It also occurs along the coast of James Bay.

Greenland shark, *Somniosus Microcephalus*. This shark, which is taken at Port Burwell, is reported by the Eskimos to be abundant. The brain of this creature is minute, but in a twelve-foot shark the liver may be approximately seven feet long and this organ yields sixty per cent oil. It is sluggish and can be pulled up on bits of string. The hide may be used in upholstery and the oils medicinally.

Other fish of lesser importance found in the waters of the Northwest Territories include goldeye, several members of the sculpin family, several varieties of ray, dog-fish in Davis Strait, and the stickleback.

Birds of the Arctic

Birds are common in the Arctic, particularly in the summer season. On some of the islands, there are vast numbers of birds which come north to breed and return south when their nesting season is over. In general it may be said that birds of one or more species may be found everywhere in the Arctic in summer but, in winter, birds are limited to a few species in particular areas. Some of the more important types to be found are listed below.

Red-throated and *Arctic loons* are found in summer on the more northern islands, where they breed. Somewhat different in coloration from the common loon of Southern Canada, they nevertheless have similar habits and utter distinctive weird cries.

Geese. Geese of various species breed on the Arctic Islands. Blue geese breed on Baffin Island in great numbers. Snow geese breed from Baffin Island north at least to the Fosheim Peninsula on Ellesmere Island. Some races of Canada geese also breed on the Arctic Islands and they have been reported from as far north as Loughheed Island. Brant geese also breed in the high Arctic.

Ducks. The commonest ducks are eiders. The king eider and the common eider are the two species which are most likely to be encountered in the Eastern Arctic. In some parts of the world these birds are very important because of their down which is collected from the nests for use

in sleeping bags and bed comforters. The Eskimos eat their eggs in some numbers, although this practice is discouraged. Other ducks of various species are found in the Arctic, but the only common one which ranges far to the northward is the old squaw. This is a rather drab brown and white little duck. The male has distinctive long tail feathers in the breeding season.

Owls. The only owl common to the high Arctic is the well-known snowy owl, which occasionally migrates southward in the winter to Southern Canada and the northern parts of the United States. In the Arctic, this bird feeds largely on lemmings and its numbers fluctuate in relation to the abundance of lemmings.

Duck hawks and *rough-legged hawks* are found occasionally in the Eastern Arctic. The most spectacular predatory bird, however, is the gyrfalcon. This falcon is found through the whole Arctic. In olden times it was greatly prized by kings and emperors as a hunting bird. Rulers as far distant as the Mediterranean countries would send expeditions north to Iceland and Greenland for the sole purpose of securing these beautiful birds.



One of the common species of bird in the Arctic regions is the kittiwake. This picture shows kittiwakes near nesting ledges on the east coast of Bylot Island, Northwest Territories.

Gallinaceous Birds. The only birds of this group which live in the high Arctic are the rock ptarmigan and the willow ptarmigan. These are the most important birds in the economy of the northland. They are widely

distributed, reaching the most northerly islands, and are prolific breeders. They form an important part of the food of the fur-bearing carnivores, and provide the only feathered game available for human food in an emergency. Except for minor fluctuations, the ptarmigan will probably maintain their numbers for many years, as vast areas are still unhunted.

Shore Birds. Shore birds of many species are common throughout the Arctic in the summer. These include the type of birds generally referred to as sandpipers and also turnstones, plovers, knots, and phalaropes. They breed both along the coasts and inland on the Arctic Islands, and all migrate south in the autumn.

Gulls. There are in the Arctic many species of gulls, some of which are virtually unknown in more southern latitudes.

Alcids. The alcids are strictly sea birds and show some resemblance to the penguins which are found chiefly in the Antarctic. They include murre, guillemots, and dovekies and all are sometimes found in almost unbelievable numbers. Colonies numbering more than a hundred thousand birds are not at all uncommon in Greenland and in some parts of the high Canadian Arctic. These birds are black and white and live almost entirely at sea except during the nesting season. They can be seen from the Strait of Belle Isle northward throughout the whole summer.

Passerine Birds. Passerine birds are not found in great variety in the Arctic, but they are present in considerable numbers. Probably the commonest and best known of these is the snow bunting, which is found as far north as there is land. A few of these birds do not migrate south but actually stay in the Arctic through the winter. The lapland longspur, another sparrow-like bird, is also common in the Eastern Arctic. Redpolls are found on the Arctic Islands, but they are not thought to range as far north as the others.

Birds of the Sub-Arctic

Birds of the sub-arctic and western regions of Canada are somewhat different from those of the Eastern Arctic, owing to the existence of wooded areas in the western region. In the lower part of the Mackenzie River basin, the bird fauna is essentially eastern as far as the Arctic Coast at 138 degrees west longitude. As the Mackenzie Valley is sheltered, it carries the range of many species far north of their limits farther east. The robin, yellow warbler, and water-thrush are found as far north as the lower islands of the Mackenzie Delta, while western influences may be seen in the Delta in species like the varied thrush and Say's phoebe. Other typical birds of the wooded area include the white-crowned sparrow, Canada jay, and spruce grouse. The unwooded area has such arctic species as the willow and rock ptarmigan, snow bunting, and lapland longspur. On the border between woods and tundra, the tree sparrow and Harris's sparrow find their nesting ground.

Geese and fresh-water ducks breed in the marshes and lakes, particularly in the Mackenzie Valley, and are of some importance as food for the residents. They also contribute migratory wildfowl for the south. The game ducks breed mostly in the Delta and in the overflow flats along the Athabasca-Slave-Mackenzie Rivers system. The lakes of the Precambrian area are, as a rule, deep and clear and as they provide little feed for ducks few breed there to augment the southern flights of autumn.

GEOLOGY

The Northwest Territories are made up of parts of four of the six physiographic divisions of Canada. The islands to the north form the Arctic Archipelago. On the west, the Mackenzie Mountains are the north-eastern extension of the Great Cordilleran region which makes up most of British Columbia and Yukon Territory. The belt bordering the Mackenzie River is the northern extension of the Interior Plains of Central Canada. East of this belt and extending over to Hudson Bay is a great area that forms part of the Canadian Precambrian Shield.

Canadian Shield

The Canadian Shield portion of the Territories is a region of comparatively low relief, rising gradually from the Arctic Ocean on the north and from Hudson Bay on the east to elevations of about 1,500 feet in its central part east of Great Bear and Great Slave Lakes. The area is hummocky, consisting of ridges and hills separated by depressions occupied by lakes or muskegs. The many lakes are of all sizes and shapes, and have irregular shorelines and many islands. For most of the area, the local relief is rarely more than 100 feet, but in places east of Great Bear Lake it is more than 1,000 feet.

The low relief of the region is the result of long continued erosion in late Precambrian time, which levelled the mountain belts that must have existed in earlier times. During the Palæozoic and Mesozoic eras this region of low relief was probably partly covered by seas that advanced over its surface and later retreated. The sediments that accumulated in these seas were largely swept away by later erosion when, during the Tertiary period, the region stood above the sea.

The oldest known rocks in the Northwest Territories are Archæan (early Precambrian) volcanic flows and sediments. The volcanic rocks, which in general are older than the more widespread sedimentary rocks, are mainly altered basic lava flows or greenstones, locally altered to chlorite or hornblende schists. The sedimentary rocks for the most part are well bedded greywackes and slates that have been altered over large areas to knotted quartz-mica schist and hornfels by the intrusion of large granite batholiths. Both the volcanic and sedimentary rocks have undergone several periods of folding and faulting and are now steeply inclined or overturned. These Early Precambrian rocks have been called the Yellowknife group and the Point Lake-Wilson Island group north of Great Slave Lake, and the Tazin series south of this lake.

During Proterozoic or later Precambrian time, there were at least two periods during which great thicknesses of sedimentary and volcanic rocks accumulated in several widely separated areas. Rocks of the older period have been recognized on the north shore of Lake Athabasca, in the east arm of Great Slave Lake, near the Arctic Coast, and in several intervening areas. On the north shore of Lake Athabasca, white and red quartzite of the Beaverlodge series overlies Archæan sediments of the Tazin series and granitic rocks, but is itself cut by granite, gabbro, and norite. Between Athabasca and Great Slave Lakes, the Nonacho series of conglomerate, slate, greywacke, arkose, and quartzite occupies an area about 100 miles long and up to 25 miles wide. The area is completely enclosed by granitic rocks, in part older, in part younger, than the Nonacho sediments. Along the east arm of Great Slave Lake, a synclinorium about 150 miles long consists of conglomerate, arkose, sandstones, quartzite, shale, slate, oolitic iron formation, dolomite, breccia, basalt, andesite, trachyte, rhyolite, porphyry, and tuff. Two or more series of strata may be represented in this assemblage, which is known as the Great Slave group. It rests unconformably on granite, and is itself intruded by syenite and diorite.

Between Great Slave and Great Bear Lakes, several areas are underlain by quartzite, arkose, conglomerate, slate, argillite, greywacke, dolomite, and limestone, with minor flows, and basic intrusions. These rocks, which resemble the lower part of the Great Slave group, have been called the Snare group. Pre-Snare and post-Snare granitic rocks occur in the vicinity. Along the east coast of Great Bear Lake and to the east is the Echo Bay group of sediments, bedded tuffs, lavas, and intrusive and extrusive porphyries. These rocks are overlain by the Cameron Bay group comprising conglomerate and red sandstone. Along the Arctic Coast, between Parry Peninsula and Bathurst Inlet, three formations of probable early Proterozoic age rest on Archæan granite. They include the Epworth dolomite, the Kanuyakcalcareous tuff and tuff-conglomerate, and the Goulburn quartzite.

Late Proterozoic time was marked by the accumulation of flows and clastic sediments over large areas. These include the Coppermine River series of the Arctic region, the Et-then series of the Great Slave Lake region, and the Athabasca series of the Athabasca-Dubawnt Rivers region. The Coppermine River series consists largely of basaltic flows interbanded with some sandstone and shale and cut by diabase sills; the Et-then series of conglomerate, sandstone, and quartzite resting unconformably on members of the Great Slave group; and the Athabasca series of white, buff, and reddish sandstone, arkose, and conglomerate.

The last great event in the geological history of the region was the spread of a continental ice mass in Pleistocene times. This had its gathering ground west of Hudson Bay, from which centre it advanced in all directions. Erratics and morainal material left by the ice are scattered over the entire region.

The more important known occurrences of minerals of possible economic interest are summarized below. Gold occurrences are widespread in the region extending northwestwards for 200 miles from the east arm of

Great Slave Lake. They are also known along and near the west coast of Hudson Bay—on Chesterfield Inlet, Wager Bay, Term Point, and the Ferguson River. Uranium and silver minerals are found at a number of places east of Great Bear Lake and to the south along the Camsell and Marian Rivers. Copper occurrences are common around Coronation Gulf and south to Great Bear Lake. A copper-nickel sulphide body containing platinum group metals occurs on Rankin Inlet on the west side of Hudson Bay. Cobalt and nickel are associated with the Great Bear Lake ores and are also found in the area adjacent to the east arm of Great Slave Lake. Low-grade iron ores are found on islands in Great Slave Lake. Lead minerals occur on the Arctic Coast, at Detention Harbour, and in the Taltson River and Pine Point areas south of Great Slave Lake. Lead-zinc copper replacement bodies are found in the Yellowknife-Beaulieu region near Homer and Tumpline Lakes. Chromite has been reported from Melville Peninsula and from the Coppermine River area. Molybdenite occurs in the Yellowknife district. Tungsten has been recovered from the gold ores on Outpost Islands, Great Slave Lake, as well as from one of the hundreds of scheelite deposits in the Yellowknife-Beaulieu region. Tin-bearing minerals have likewise been found in both of these districts. Tantalum, beryllium, and lithium minerals occur in pegmatites in the Yellowknife-Beaulieu region. Fluorite is reported from Baker Lake and from Snare River. Semi-precious gems, including sapphire, dichroite, chiasolite, jade, and lazulite have been found along and near the western margin of the Shield.

Cordilleran Region

An area of some 30,000 square miles of the Northwest Territories, west of the Mackenzie River and between the Peel River on the north and the Liard River on the south, is part of the great Cordilleran region of Western Canada. The Mackenzie Mountains, forming this region and a part of Yukon Territory, are made up of ranges trending in a northwest direction and ranging in elevation up to over 8,000 feet with a relief, where explored, of 3,000 to 4,500 feet. The drainage of the area is to the Mackenzie, the chief streams being the Arctic Red River, the Carcajou, the Keele (formerly the Gravel), the Roote, the North Nahanni, and the South Nahanni, the last of which empties into the Liard. These streams have steep gradients. On the Keele River, where the belt is widest, the high mountains lie about 50 miles from the Mackenzie River, and between them and the Mackenzie lowlands is a zone of foot-hills about 3,000 feet in height. Farther south at the "Great Bend" of the Mackenzie near where the latter is joined by the North Nahanni, the mountain front is an abrupt escarpment whose top is 2,000 to 3,000 feet above the valley plain.

The rocks of the range are chiefly sediments of Palæozoic age ranging from Upper Cambrian to Carboniferous. The rocks of the eastern belt are heavily bedded limestones, dolomites, sandstones, and conglomerates. Nahanni Peak, one of the striking mountain features to be seen by the traveller descending the Mackenzie River, is composed of Middle Devonian

strata. Lying above the hard limestones are Upper Devonian shales which have a thickness of as much as 2,000 feet, and above these is a limestone zone 800 to 1,100 feet thick. This in turn is succeeded by other shale and limestone facies from 1,300 to 1,500 feet thick, all of Upper Devonian age. On the North Nahanni, the Middle Devonian rocks form an anticline, with steep dips on the east and more gently inclined beds on the west.

In Pleistocene times, the Mackenzie Mountains were occupied by the northern extension of the Cordilleran ice-sheet which here had a thickness of about 3,000 feet. The higher peaks were not covered.

Not many mineral occurrences have been reported from the Cordilleran part of the Northwest Territories, owing in part, at least, to the fact that only very limited exploration and prospecting have been carried on. Iceland spar has been recovered from deposits in the northern part of the mountains; low-grade iron ores are exposed along the Keele (Gravel) River; and placer gold has been found along the Peel, Nahanni, and Liard Rivers. Zinc-lead replacement deposits have recently been found near the headwaters of the Keele River.

The Interior Plains

The Mackenzie lowland includes the belt between the Cordilleran region on the west and the Canadian Shield on the east. It begins on the Slave River, embraces the basin at the west end of Great Slave Lake, and continues down to the Arctic Coast. On the Slave River its elevation is about 700 feet, and from there northward the surface slopes gradually to the Arctic Ocean. North of the North Nahanni River, the lowland is divided by the long, narrow ridge of the Franklin Mountains, and consists of a western part varying in width from 20 to 80 miles through which the Mackenzie River flows, and an eastern part occupying all but the east side of the drainage basin of Great Bear Lake. The highest summit is Mount Clark of the Franklin Range, which has an elevation between 3,000 and 4,000 feet.

The Mount Clark formation consists of red quartzites and sandstones of probable Lower Cambrian age. Above these lies the Middle Cambrian Mount Cap formation of grey, green, and red sandstones and shales. These in turn are overlain by a series of red and green shales with gypsum and salt bearing beds of uncertain age lying between Middle Cambrian and Upper Silurian beds. Shale beds of possible Ordovician age are exposed at the base of Mount Kindle east of Wrigley.

Rocks of Ordovician and Silurian age form the base of the Palæozoic section along a considerable part of the eastern edge of the lowland belt, where the Palæozoic sediments overlap the Precambrian rocks of the Canadian Shield. On the west side of the north arm of Great Slave Lake, Ordovician sediments form an escarpment which probably continues northward to Great Bear Lake. Silurian limestone and gypsiferous dolomite occur along the Slave River, and silurian strata are also exposed on Lone Mountain near the mouth of the North Nahanni River, in Bear Mountain near Norman, and on Mount St. Charles on the Great Bear River.

The silurian strata are succeeded unconformably by beds of Devonian age which form the surface rocks over the greater part of the Mackenzie Lowland region. On Great Slave Lake, the Devonian strata have been divided into three formations, in ascending order: the Pine Point limestone, about 100 feet thick; the Presqu'île dolomite, with an estimated thickness of 200 feet; and the Slave Point limestone, about 160 feet thick. Along the lower Mackenzie, the following formations have been correlated with these respectively; the Hare Indian River shales, over 300 feet thick; The Ramparts limestone, 250 feet thick; and the Beavertail limestone, 350 feet thick. The Ramparts limestone is so named from its excellent exposures in The Ramparts section just above Fort Good Hope.

Sandstones and shales of Cretaceous age cover considerable areas in the Mackenzie Lowland region. They outcrop on the Liard River near the southern border of the Territories, along the Mackenzie north of the



The Arctic hare is an important source of food for natives and for wild animals. One of the most common species is the barren grounds hare, which retains its white colour throughout the year.

Dahadinni River in several disconnected stretches, and along the western shores of Great Bear Lake. The beds are largely of marine origin, but in places some of the lower strata carry coal seams. At the mouth of the Bear River, a basin of partly consolidated Tertiary sands and clay with lignite beds has a length of 30 to 40 miles and a width of from 20 to 30 miles. The beds are of lacustrine origin.

The mineral resources of the Interior Plains include salt, gypsum, the mineral fuels, lead, zinc, and iron. Oil seepages have been reported from numerous places in the Mackenzie River Valley. Lignitic coal occurs near Fort Norman and Aklavik, and on the east coast of Great Bear Lake. Salt and gypsum deposits are widespread throughout the Interior Plains: some deposits have been put to local use. Ferruginous beds outcrop in the Franklin Mountains. Lead and zinc minerals are found in Devonian limestones near Pine Point on the south shore of Great Slave Lake.

Comparatively little is known of the geology of the Arctic Archipelago. Available information suggests that, like the mainland part of the Northwest Territories, a three-fold division into Shield, Plains, and Mountains is warranted. Thus, the southeastern islands are composed chiefly of crystalline rocks of Precambrian age. Northwesternly, these become overlain by nearly flat Palaeozoic sandstones and limestones, with successively younger strata, including carboniferous coal seams, generally similar in age and structure to the rocks of the Interior Plains, appearing at the surface. In the extreme northwestern part of the archipelago, observations at a few widely separated districts suggest the existence of a mountain range, consisting largely of folded and intruded Mesozoic rocks extending southwesterly for nearly a thousand miles from northern Ellesmere Island through the Sverdrup group.

Occurrences of graphite and mica near the southeast coast of Baffin Island have been known for more than 360 years; some mining has been done for both these minerals. Coal has long been mined for local use from a small basin of Tertiary rocks near Pond Inlet on Baffin Island. One hundred miles to the west, platinum, nickel, and silver occurrences have been reported from Admiralty Inlet. Iron ores are found in rocks of Proterozoic age on Belcher and Nastapoka Islands in Hudson Bay; at the latter locality they contain appreciable amounts of manganese.

CLIMATE

The Northwest Territories comprise two main, broad-scale climatic divisions: the Arctic Islands, including the region of the mainland north of the tree-line, commonly known as the Barren Lands, and the areas bordering the Mackenzie River south of the tree-line. The tree-line extends, in a general southeasterly direction, from the mouth of the Mackenzie River to the west coast of Hudson Bay just south of Churchill, Manitoba.

In the winter, over most of the Northwest Territories, there is generally a vast high-pressure area, flanked by low-pressure areas over the Aleutian Islands to the west and over Davis Strait to the east. The high pressure area does not remain limited within fixed boundaries but, at intervals throughout the winter, outbreaks of cold, dry air occur and these travel southward along the Mackenzie Valley finally to project arctic conditions into the Prairie Provinces. These polar outbursts cease for short periods, or are displaced eastward to the vicinity of Hudson Bay and warmer air from the North Pacific region, or from the Bering Sea, flows by way of the Aleutians over the Mackenzie Valley causing temperatures to rise. Thus, winters in the Mackenzie Valley area may be moderately cold or extremely

cold from year to year depending upon which control is the more dominant. An extremely cold winter was experienced in this area in 1946-47, when a temperature of -81.4° was recorded at Snag Airport in the Yukon in February, 1947.

Average winter temperatures over the Arctic Islands are consistently low, the lowest that are to be found anywhere in Canada. Over the more northerly islands, mean monthly temperatures are below zero for seven months of the year, from October to April. For example, from November 11, 1948, to April 27, 1949, the temperature at Eureka rose above zero on only three occasions.

At intervals during the winter, deep cyclonic storms from Eastern Canada and the United States move northeastward towards the semi-permanent trough of low pressure over Davis Strait. The circulation around these storms causes mild air from the Atlantic to be transported over the Arctic Islands adjacent to Davis Strait and Baffin Bay, and temperatures may rise to near the freezing point. These incursions of warm air rarely penetrate farther westward than Cornwallis Island.

During the brief summer period, the ice-filled waters surrounding the islands prevent the air in contact with them from warming up to any great extent. Mean summer temperatures throughout the archipelago show little variation from year to year, and the average temperature of the warmest month, July, is generally near 40°F .

The climate of the Mackenzie Valley area is known as a sub-arctic type, for although average winter temperatures are nearly as low as those over the Arctic Islands, summers are comparatively warm with mean July temperatures near 60°F . The climate of this region is similar to that found in Ontario north of Lake Superior, and in Quebec north of the Gulf of St. Lawrence.

During the summer months, the pronounced Mackenzie Valley high pressure area, which dominates the winter pressure regime, is absent. Instead, a shallow high pressure system is situated over the Archipelago. The absence of the high pressure ridge over the Mackenzie Valley permits warmer air from the North Pacific region or from more southerly latitudes to flow into this area. The heat may become truly oppressive on many summer days under this influence. Temperatures over 90°F have been recorded in most summers, and indeed, a high of 103°F has occurred at Fort Smith. However, there are also summers when polar outbursts are more intense or more frequent. This causes cooler weather in the Mackenzie Valley area but has the compensating advantage of causing heavier precipitation in the wheat region south of latitude 60°F .

The central and northern portions of the Arctic Archipelago seldom obtain any relief from purely polar conditions. Average temperatures in January are mainly in the range of -30°F to -40°F and between 40°F and 45°F in July.

Because of the high latitude of the Northwest Territories, there are long periods of daylight during the summer, and this fact is often advanced in support of agricultural possibilities in the Mackenzie Valley. Since southern

Baffin Island has no agriculture, although in the same latitude and consequently with the same duration of sunlight as the Mackenzie Valley, it is apparent that other climatic factors act as controls. Agriculture is not possible in the Arctic Islands because of lack of developed soil, and the coolness of the summer which gives only a short frost-free period. Agriculture is possible, although somewhat precarious, in northwestern Canada because of the warm air masses raising summer temperatures.

Contrary to general belief, snowfall is not heavy in the Northwest Territories. Snow remains on the ground for a long time owing to the low winter temperatures. Annual precipitation of 10 to 13 inches in the Mackenzie Valley includes 40 to 50 inches of snow (10 inches of snow equivalent to one inch of rain), or about half of the snowfall of the Great Lakes, St. Lawrence River, and northern New England regions. Rain falls from June to October, but is not overly abundant.

Precipitation is even less over the Arctic Islands and the Barren Grounds. Over most of the region the annual total is five to 10 inches, with a little more than one-half occurring as snow. The amount drops to less than five inches over the more northerly islands, and Eureka, with an average of less than two inches, has the lowest precipitation of any station in Canada.

Southern Baffin Island has a greater precipitation than the remainder of the archipelago since it lies near the mean path of cyclonic storms from Eastern Canada. The annual total precipitation over this area is nearly 15 inches, with about one-half occurring as snow.

The following table of mean temperatures illustrates the climatic difference between the eastern and western sections of the Northwest Territories, comparing them with stations near the same latitude in Europe:

	<i>January</i>	<i>July</i>
Near Latitude 60°N	(°F)	(°F)
Fort Smith, N.W.T.	—14	61
Lake Harbour, N.W.T. . . .	—12	46
Bergen, Norway	34	58
Marieham, Finland	27	59
Near Latitude 65°N		
Fort Good Hope, N.W.T. . .	—24	59
Pangnirtung, N.W.T.	—16	46
Uleaborg, Finland	15	59
Jockmökk, Sweden	6	58
Near Latitude 75°N		
Winter Harbour, N.W.T. . .	—30	42
Craig Harbour, N.W.T. . . .	—21	41
Bear Island (off Norway) . .	15	40
Near Latitude 80°N		
Eureka, N.W.T.	—37	43
Bache Peninsula, N.W.T. . .	—26	41
Quade Hock (Spitzbergen) . .	7	40

Until recent years, meteorological records of settlements and trading posts in the Northwest Territories were quite limited. Most of the radio stations now operated by the Department of National Defence and the Department of Transport also serve as weather stations, and comparative records covering longer periods are gradually being acquired. The most recent development in the Far North has been the establishment of meteorological stations operated jointly by the Canadian Department of Transport and the United States Weather Bureau in the far northern Arctic Islands. The most remote station was established in April, 1950, at Alert, on Ellesmere Island, near the most northerly tip of North America.

EDMOND CLOUTIER, C.M.G., O.A., D.S.P.
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